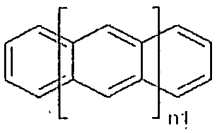
Claims

1. An organic silane compound represented by the general formula (a);

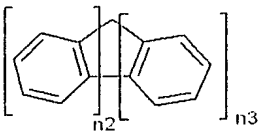
$(T)_k$-$SiX^1X^2X^3$ (a)

wherein T is an organic group derived from a fused polycyclic hydrocarbon compound of a fusion number of 2 to 10 composed of a 5-membered and/or 6-membered monocyclic hydrocarbon; k is an integer of 1 to 10; at least one group of X^1 to X^3 is a group which gives a hydroxy group by hydrolysis, or a halogen atom, and other groups of X^1 to X^3 are a group which does not react with an adjacent molecule.

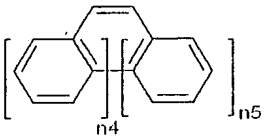
2. The organic silane compound according to claim 1, wherein T is the organic group derived from a fused polycyclic hydrocarbon compound selected from the group consisting of compounds represented by the general formulas (I) to (IX);



(I)



(II)



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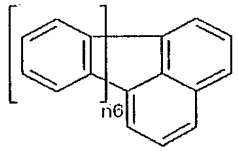
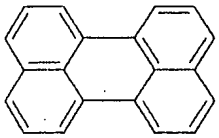


(IV)



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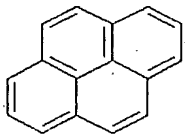

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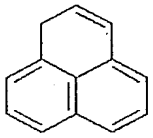
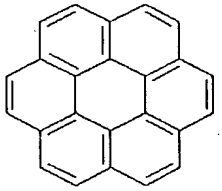
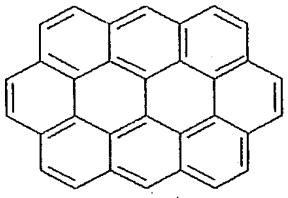


(VII)



(VIII)



(IX)

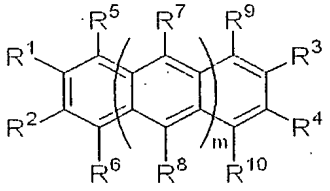
in the formula (I), n^1 is an integer of 0 to 10; in the formula (II), n^2 and n^3 are integers of 0 or more, a sum of which is 1 to 9, respectively; in the formula (III), n^4 and n^5 are integers of 1 or more, a sum of which is 2 to 9, respectively; in the formula (IV), n^6 is an integer of 0 to 7; in the formula (X), Y is an atom selected from carbon, nitrogen, oxygen and sulfur atoms, or an organic residue containing any of these atoms.

3. The organic silane compound according to claim 1, wherein the organic group further has a functional group, and the functional group is a substituted or unsubstituted alkyl group, a halogenated alkyl group, a cycloalkyl group, an aryl group, a diarylamino group, a di- or

triarylalkyl group, an alkoxy group, an oxyaryl group, a nitrile group, a nitro group, or an ester group.

4. The organic silane compound according to claim 1, wherein the group which does not react with the adjacent molecule is a substituted or unsubstituted alkyl group, a cycloalkyl group, an aryl group, a diarylamino group, or a di- or triarylalkyl group.

5. The organic silane compound according to claim 3, wherein the fused polycyclic hydrocarbon compound is represented by the formula (1);



(1)

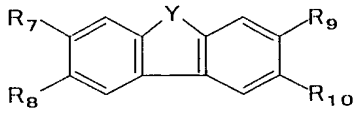
wherein m is 0 to 10; at least one group of R^1 to R^{10} is a silyl group represented by the general formula $-SiX^1X^2X^3$ (at least one group of X^1 to X^3 is a group which gives a hydroxy group by hydrolysis, or a halogen atom, and other groups are a group which does not react with an adjacent molecule), and at least one group is an electron donating or electronattracting functional group, and other groups are a hydrogen atom.

6. The organic silane compound according to claim 5, wherein m is 0 to 7.

7. The organic silane compound according to claim 5, wherein at least one of R^1 and R^2 is the silyl group, and R^3 and R^4 are both a linear hydrocarbon group of a carbon number of 1 to 30.

8. The organic silane compound according to claim 5, wherein one of R^3 and R^4 is a linear hydrocarbon group of a carbon number of 1 to 30, and the other is a hydrogen atom.

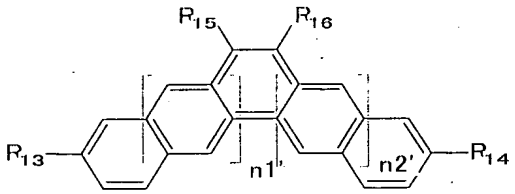
9. The organic silane compound according to claim 3, wherein the organic silane compound is represented by the formula (V);



(V)

wherein R^7 and R^8 are the same or different, and are a silyl group represented by $SiX^1X^2X^3$, or a hydrogen atom (provided that the case where R^7 and R^8 are a hydrogen atom at the same time is not included), Y is selected from $C(R^{11})_2$, NR^{12}, O and S (herein, R^{11} and R^{12} are a hydrogen atom, and may be directly bound to other functional group), X^1 to X^3 are the same or different, and are an alkoxy group represented by $O(CH_2)_mCH_3$ (m=0 to 9), or a halogen atom, and R^9 and R^{10} are a hydrophobic group or hydrogen atom (provided that the case where R^9 and R^{10} are a hydrogen atom at the same time is not included).

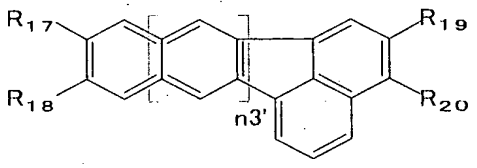
10. The organic silane compound according to claim 3, wherein the organic silane compound is represented by the formula (III)';



(III)'

wherein R^{13} is a silyl group represented by $SiX^1X^2X^3$, R^{14} to R^{16} are the same or different, and are a hydrophobic group or a hydrogen atom (provided that the case where R^{14} to R^{16} are a hydrogen atom at the same time is not included), $n^{1'}$ and $n^{2'}$ are integers, a sum of which is 0 to 8, and X^1 to X^3 are the same or different, and are an alkoxy group represented by $O(CH_2)_mCH_3$ (m=0 to 9), or a halogen atom.

11. The organic silane compound according to claim 3, wherein the organic silane compound is represented by the formula (IV)';



(IV)'

wherein R^{17} to R^{20} satisfy any of the following two conditions:

condition 1: R^{17} and R^{18} are the same or different, and are a silyl group represented by $SiX^1X^2X^3$, or a hydrogen atom (provided that the case where R^{17} and R^{18} are a hydrogen atom at the same time is not included), R^{19} and R^{20} are the same or different, and are a hydrogen atom or a hydrophobic group (provided that the case where R^{19} and R^{20} are a hydrogen atom at the same time is not included), and X^1 to X^3 are the same or different, and are an alkoxy group represented by $O(CH_2)_mCH_3$ (m=0 to 9), or a halogen atom,

condition 2: R^{19} and R^{20} are the same or different, and are a silyl group represented by $SiX^1X^2X^3$, or a hydrogen atom (provided that the case where R^{19} and R^{20} are a hydrogen atom at the same time is not included), R^{17} and R^{18} are the same or different, and are a hydrogen atom or a hydrophobic group (provided that the case where R^{17} and R^{18} are a hydrogen atom at the same time is not included), and X^1 to X^3 are the same or different, and are an alkoxy group represented by $O(CH_2)_mCH_3$(m=0 to 9), or a halogen atom.

12. A process for producing an organic silane compound, comprising Subjecting to the Grignard reaction of a compound represented by the general formula (b);

$$(T)_k\text{-}MgL^1 \quad (b)$$

wherein T is an organic group derived from a fused polycyclic hydrocarbon compound of a fusion number of 2 to 10 composed of a 5-membered and/or 6-membered monocyclic hydrocarbon; k is an integer of 1 to 10; L^1 is a halogen atom, and a compound represented by the general formula (c);

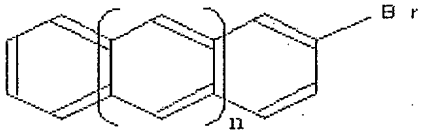
$$L^2\text{-}SiX^1X^2X^3 \quad (c)$$

wherein L^2 is a hydrogen atom, a halogen atom, or an alkoxy group of a carbon number of 1 to 4; at least one group of X^1 to X^3 is a group which gives a hydroxy group by hydrolysis, or a halogen atom, and other groups are a group which does not react with an adjacent molecule, to obtain a π electron conjugation system organic silane compound represented by the general formula (a);

$(T)_k$-$SiX^1X^2X^3$ (a)

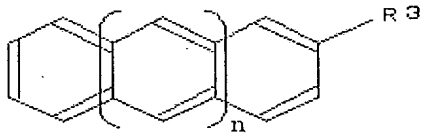
wherein T, k, and X^1 to X^3 are as defined above.

13. The process for producing an organic silane compound according to claim 12, wherein, via a first step of reacting a naphthalene derivative represented by the formula (1-1);



(1 − 1)

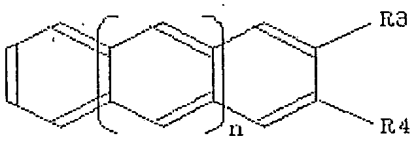
wherein n is an integer of 0 to 10, with R^3-Br (R^3 is a hydrophobic group) using a Grignard reaction to form an intermediate represented by the formula (1-2);



(1 − 2)

wherein n and R^3 are as defined above,

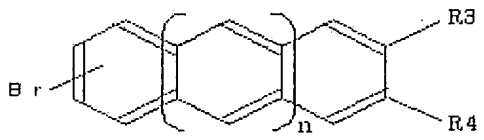
a second step of brominating an α carbon of R^3 of the intermediate, and Subjecting to the Grignard reaction of this with R^4-Br (R^4 is a hydrophobic group) to form the formula (1-3);



(1 − 3)

wherein n, R^3 and R^4 are as defined above,

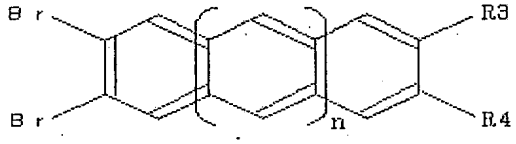
a third step of brominating the intermediate represented by the formula (1-3) to obtain an intermediate represented by the formula (1-4);



(1 − 4)

wherein n, R^3 and R^4 are as defined above,

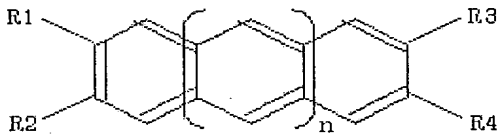
or the formula (1-5);



(1 − 5)

wherein n, R^3 and R^4 are as defined above, and

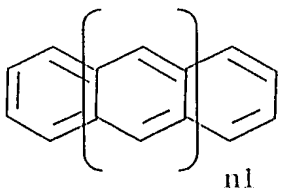
a fourth step of reacting the intermediate represented by the formula (1-4) and (1-5) with a silane compound represented by $H\text{-}SiX^1X^2X^3$ (provided that at least one group of X^1 to X^3 is a group which gives a hydroxy group by hydrolysis, or a halogen atom, and other groups are a group which does not react with an adjacent molecule), thereby obtain the formula (I)';



(I)'

wherein n, and R^1 to R^4 are as defined above.

14. The process for producing an organic silane compound according to claim 12, wherein T is represented by the formula (I);



(I)

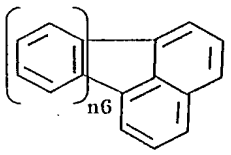
wherein n^1 is an integer of 0 to 10, and

a fused polycyclic hydrocarbon compound represented by the formula (I) is obtained by:

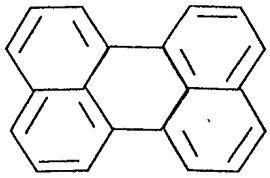
(1) a method of repeating a step of substituting a hydrogen atom binding to adjacent two carbon atoms of a raw material compound with an ethynyl group or a derivative thereof, and ring-closing reacting ethynyl groups, or

(2) a method of repeating a step of substituting a hydrogen atom binding to a carbon atom of a raw material compound with a triflate group, reacting this with furan or a derivative thereof, and then oxidizing this.

15. The process for producing an organic silane compound according to claim 12, wherein T is represented by the formula (IV) or (V);



(IV)



(V)

wherein n^6 is an integer of 0 to 7, and

a fused polycyclic hydrocarbon compound represented by the formula (IV) or (V) is obtained by a method of repeating a step of substituting a hydrogen atom binding to adjacent two carbon atoms of a raw material compound with an ethynyl group or a derivative thereof, and ring-closing reacting ethynyl groups.

16. A functional organic thin film comprising a thin film which is

derived from an organic silane compound represented by the general formula (a);

$$(T)_k\text{-}SiX^1X^2X^3 \quad (a)$$

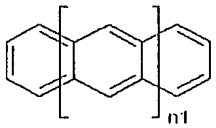
wherein T is an organic group derived from a fused polycyclic hydrocarbon compound of a fusion number of 2 to 10 composed of a 5-membered and/or 6-membered monocyclic hydrocarbon; k is an integer of 1 to 10; at least one group of X^1 to X^3 is a group which gives a hydroxy group by hydrolysis, or a halogen atom, and other groups are a group which does not react with an adjacent molecule, and is bound to a substrate via a siloxane bond.

17. The functional organic thin film according to claim 16, wherein the organic group further has a hydrophobic group, and the hydrophobic group is a substituted or unsubstituted alkyl group, a halogenated alkyl group, a cycloalkyl group, an aryl group, a diarylamino group, a di- or triarylalkyl group, an alkoxy group, an oxyaryl group, a nitrile group, a nitro group, or an ester group.

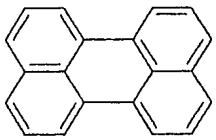
18. The functional organic thin film according to claim 16, wherein the group which does not react with the adjacent molecule is a substituted or unsubstituted alkyl group, a cycloalkyl group, an aryl group, a diarylamino group, or a di- or triarylalkyl group.

19. The functional organic thin film according to claim 16, wherein T is the organic group derived from a fused polycyclic

hydrocarbon compound selected from the group consisting of compounds represented by the general formulas (I) to (IX);



(I)



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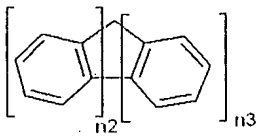
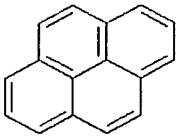


(II)



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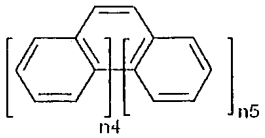

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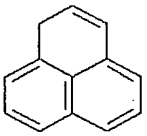

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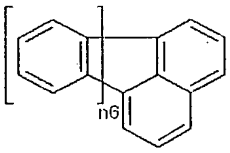

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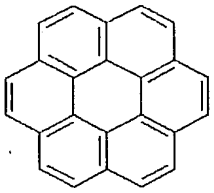
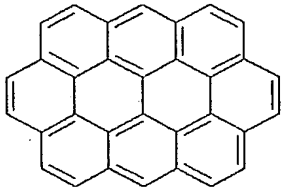


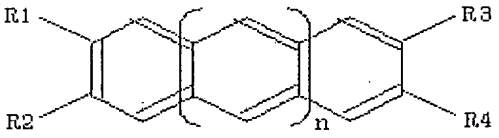
(VIII)



(IX)

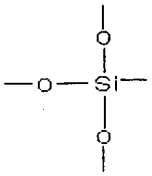
(in the formula (I), n^1 is an integer of 0 to 10; in the formula (II), n^2 and n^3 are integers of 0 or more, a sum of which is 1 to 9, respectively; in the formula (III), n^4 and n^5 are integers of 1 or more, a sum of which is 2 to 9, respectively; in the formula (IV), n^6 is an integer of 0 to 7; in the formula (X), Y is an atom selected from carbon, nitrogen, oxygen and sulfur atoms, or an organic residue containing any of these atoms).

20. The functional organic thin film according to claim 16, wherein the thin film is represented by the formula (I)";



(I) ''

wherein n is an integer of 0 to 10, at least one of R^1 and R^2 constitutes a network composed of the following siloxane bond;



and is bound to the substrate via the siloxane bond (provided that the case where R^1 and R^2 are a hydrogen atom at the same time is not included), and R^3 and R^4 are a hydrophobic group, or a hydrophobic group and a hydrogen atom.

21. The functional organic thin film according to claim 20, wherein n is 0 to 7.

22. The functional organic thin film according to claim 20, wherein R^3 and R^4 are both a linear hydrocarbon group of a carbon number of 1 to 30.

23. The functional organic thin film according to claim 20, wherein one of R^3 and R^4 is a linear hydrocarbon group of a carbon number of 1 to 30, and the other is a hydrogen atom.

24. A process for manufacturing a functional organic thin film, comprising subjecting an organic silane compound represented by the

general formula (a);

$(T)_k$-$SiX^1X^2X^3$ (a)

wherein T is an organic group derived from a fused polycyclic hydrocarbon compound of a fusion number of 2 to 10 composed of a 5-membered and/or 6-membered monocyclic hydrocarbon; k is an integer of 1 to 10; at least one group of X^1 to X^3 is a group which gives a hydroxy group by hydrolysis, or a halogen atom, and other groups are a group which does not react with an adjacent molecule, to a chemical binding method to bind to a substrate via a siloxane bond.

25. The process for manufacturing a functional organic thin film according to claim 24, wherein the chemical binding method is a LB method.

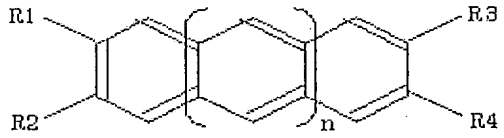
26. An organic thin transistor, comprising a substrate, a functional organic thin film which is derived from an organic silane compound represented by the general formula (a);

$(T)_k$-$SiX_1X_2X_3$ (a)

wherein T is an organic group derived from a fused polycyclic hydrocarbon compound of a fusion number of 2 to 10 composed of a 5-membered and/or 6-membered monocyclic hydrocarbon; k is an integer of 1 to 10; at least one group of X_1 to X_3 is a group which gives a hydroxy group by hydrolysis, or a halogen atom, and other groups are a group which does not react with an adjacent molecule, and is bound to a substrate via a siloxane bond, a gate electrode formed on one surface of

the functional organic thin film via a gate insulating film, and a source electrode/a drain electrode which are formed on both sides of the gate electrode, contacting with one surface or other surface of the functional organic thin film.

27, The organic thin film transistor according to claim 26, wherein the organic silane compound is represented by the formula (I)';



(I)'

wherein n is an integer of 0 to 10, R^1 and R^2 are the same or different, and are a silyl group represented by $SiX^1X^2X^3$, or a hydrogen atom (provided that the case where R^1 and R^2 are a hydrogen atom at the same time is not included), X^1 to X^3 are as defined above, and R^3 and R^4 are a hydrophobic group, or a hydrophobic group and a hydrogen atom.

28. A process for manufacturing an organic thin film transistor, comprising the steps of (A) forming a functional organic thin film which is derived from an organic silane compound represented by the general formula (a);

$$(T)_k\text{-}SiX^1X^2X^3 \quad (a)$$

wherein T is an organic group derived from a fused polycyclic hydrocarbon compound of a fused number of 2 to 10 composed of a 5-membered and/or 6-membered monocyclic hydrocarbon; k is an integer of 1 to 10; at least one group of X^1 to X^3 is a group which gives a

hydroxy group by hydrolysis, or a halogen atom, and other groups are a group which does not react with an adjacent molecule, and is bound to a substrate via a siloxane bond, directly or indirectly on the substrate, (B) forming a gate electrode indirectly or directly on the substrate, (C) forming a source electrode•a drain electrode on one surface side or other surface side of the functional organic thin film, and (D) forming a gate insulating film between the gate electrode and the source electrode•drain electrode.

29. An organic electroluminescence device, comprising having one or more organic thin films between an anode and a cathode, wherein at least one organic thin film is a functional organic thin film which is derived from an organic silane compound represented by the general formula (a);

$(T)_k$-$SiX^1X^2X^3$ (a)

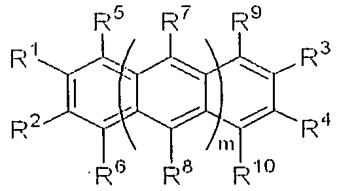
wherein T is an organic group derived from a fused polycyclic hydrocarbon compound of a fusion number of 2 to 10 composed of a 5-membered and/or 6-membered monocyclic hydrocarbon; k is an integer of 1 to 10; at least one group of X^1 to X^3 is a group which gives a hydroxy group by hydrolysis, or a halogen atom, and other groups are a group which does not reactive with an adjacent molecule, and is bound to the anode, the cathode or other organic thin film via a siloxane bond.

30. The organic electroluminescence device according to claim 29, wherein the construction having one or more organic thin films

between the anode and the cathode is a construction of anode-light emitting layer-electron transporting layer-cathode or a construction of anode-hole transporting layer-light emitting layer-electron transporting layer-cathode, and the electron transporting layer is bound to the light emitting layer via a chemical bond.

31. The organic electroluminescence device according to claim 29, wherein the construction having one or more organic thin films between the anode and the cathode is a construction of anode-hole transporting layer-light emitting layer-cathode or a construction of anode-hole transporting layer-light emitting layer-electron transporting layer-cathode, and the hole transporting layer is bound to the anode via a chemical bond.

32. The organic electroluminescence device according to claim 29, wherein the organic silane compound is represented by the formula (1);



(1)

wherein m is 0 to 10; at least one group of R^1 to R^{10} is a silyl group represented by the general formula-$SiX^1X^2X^3$ (at least one group of X^1 to X^3 is a group which gives a hydroxy group by hydrolysis, or a halogen atom, and other groups are a group which does not react with an adjacent molecule), at least one group is an electron donating or

electronattracting functional group, and other groups are a hydrogen atom.

33. The organic electroluminescence device according to claim 29, wherein the group which does not react with the adjacent molecule is a substituted or unsubstituted alkyl group, a cycloalkyl group, an aryl group, a diarylamino group, or a di- or triarylalkyl group.